

UNITED STATES DEPARTMENT OF AGRICULTURE

**Soil Survey
of
Washington County, North
Carolina**

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In cooperation with the North Carolina Department of Agriculture
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SOIL SURVEY

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SOIL SURVEY OF WASHINGTON COUNTY, NORTH CAROLINA

By W. A. DAVIS, North Carolina Department of Agriculture and North Carolina Agricultural Experiment Station, in Charge, and K. V. GOODMAN, United States Department of Agriculture

COUNTY SURVEYED

Washington County is in the northeastern part of North Carolina (fig. 1). Roanoke River and Albemarle Sound form its northern boundary, and Welch Creek separates it from Martin County on the west. Plymouth, the county seat, is about 70 miles east of Rocky Mount and 20 miles south of Edenton. The area of the county is 346 square miles, or 221,440 acres.

In general the surface relief is level, undulating, and gently rolling, the rolling areas being interspersed with a few small swamps and slight depressions. The greater part of the county is flat or almost level. Topographically there are two well-defined marine terraces—the Chowan terrace, which occupies most of the western half of the county and represents the most elevated part, and the Pamlico terrace, occupying the eastern half, and representing the low, almost level part. The well-defined escarpment between these two terraces is on the highway about halfway between Skinnersville and Scuppernong. This boundary swings in a southwest-erly direction and in a general way follows the boundary between the peat and muck areas and the mineral soils. There is a drop of about 5 feet in some places from the Chowan terrace to the Pamlico terrace, but in most places the line between these terraces is not so well defined as it is along the highway.

The greater part of the Chowan terrace has an undulating, gently rolling surface relief and fairly good surface drainage, whereas practically all of the Pamlico terrace requires artificial drainage, and this, in many places, is accomplished by open ditches and canals. Only a comparatively small proportion of the county is naturally well drained. Drainage in the northeastern, northern, north-central, and extreme western parts ranges from fair to good and is effected mainly through the natural drainageways leading into Roanoke River and Albemarle Sound. The extreme eastern part, or that section lying between Creswell and Lake Phelps, drains into Scuppernong River. A small area in the vicinity of Wenona in the extreme southern part drains southward through canals. The vast areas of peat and muck and of the Hyde, Portsmouth, and Bladen soils are naturally very poorly drained. Canals totaling a large mileage have been constructed in the vicinity of Wenona, to the south of Roper, and between Scuppernong River and Lake Phelps.



FIGURE 1.—Sketch map showing location of Washington County, N. C.

In addition to the beautiful Albemarle Sound on the north, two large lakes—Lake Phelps and Pungo Lake—in the extreme southeastern part of the county are conspicuous features in the peat area.

As shown by the United States Geological Survey, the elevation above sea level at Plymouth is 19.3 feet, at Wenona 16 feet, and at Creswell 12.4 feet.

Washington County was formed from Tyrrell County in 1779. The early settlers were chiefly of English descent. The population of the county, as reported by the Federal census of 1930, is 11,603, all classed as rural, and the average density is 35.5 persons a square mile. Settlement is confined chiefly to the northern half. There are no very large towns. Plymouth, the county seat, has a population of 2,139. Other important towns are Roper, Mackeys, and Creswell, which are local markets for the agricultural products of the county. The outside markets are Norfolk, Richmond, Greenville, Wilson, and Rocky Mount. Most of the tobacco is sold in Greenville, Wilson, and Rocky Mount.

Two railroads, the Norfolk Southern and the Atlantic Coast Line, serve the county. Roanoke River is navigable throughout its course along the northern boundary, and small boats navigate as far as Plymouth, furnishing cheap transportation for some classes of freight. A ferry operates four times daily between Mackeys and Edenton. Two State highways traverse the county. Most of the county roads and private roads are good in dry weather, but during the winter and in rainy weather a few are almost impassable.

Telephone service is fair, and rural delivery of mail reaches practically all sections. Churches and schoolhouses are conveniently located. Well water is available at a depth ranging from 10 to 20 feet and artesian water at a depth of about 200 feet.

CLIMATE

The climate of Washington County is oceanic, that is, it is affected by the proximity of the Atlantic Ocean. The summers are long and hot, and the winters, as a rule, are mild, but there are a few days when the temperature is below freezing. The average length of the frost-free season is 184 days, from April 22, the average date of the latest killing frost, to October 23, the average date of the earliest.

The greater part of the rainfall occurs during the growing season, but, as a rule, it is well distributed throughout the year. The fall months are usually dry, thus allowing the farmers good weather in which to harvest their crops. The long growing season and abundant moisture render this county climatically a good agricultural section. A few hardy vegetables and truck crops, such as cabbage, English peas, potatoes, beets, and string beans, can be successfully grown for late spring shipment, and cover crops can be grown throughout the year. Farm work can be carried on a greater part of the time.

Table 1 gives the normal monthly, seasonal, and annual temperature and precipitation, as recorded at the United States Weather Bureau station at Wenona. These data are fairly representative for the county as a whole.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Wenona, Washington County, N. C.*

[Elevation, 16 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1927)	Total amount for the wettest year (1917)
December.....	°F. 44.1	°F. 78	°F. 3	Inches 3.88	Inches 5.55	Inches 2.09
January.....	42.4	75	-4	4.18	.97	5.39
February.....	45.2	78	9	3.86	3.20	1.89
Winter.....	43.9	78	-4	11.92	9.72	9.37
March.....	50.9	85	18	3.39	2.13	3.56
April.....	58.4	93	21	3.66	3.42	5.13
May.....	66.0	96	34	3.84	2.67	2.54
Spring.....	58.4	96	18	10.89	8.22	11.23
June.....	73.3	100	42	5.82	3.12	11.09
July.....	76.2	99	44	7.47	3.72	13.30
August.....	75.5	100	43	5.93	5.49	5.80
Summer.....	75.0	100	42	19.22	12.33	30.19
September.....	70.5	99	37	5.53	1.57	13.46
October.....	61.5	93	24	2.74	2.10	3.93
November.....	50.5	85	18	2.90	3.56	1.38
Fall.....	60.8	99	18	11.17	7.23	18.75
Year.....	59.5	100	-4	53.20	37.50	69.54

AGRICULTURAL HISTORY AND STATISTICS

Agriculture in Washington County began more than 200 years ago. The early settlers occupied the well-drained sandy land along Roanoke River and Albemarle Sound, and the agriculture consisted in the production of wheat and corn and the raising of livestock. The manufacture of tar, pitch, and turpentine was a source of income. Cotton became the principal cash crop after the invention of the cotton gin.

Table 2, compiled from the reports of the Federal census, gives the acreage devoted to the principal crops in the years 1879, 1889, 1899, 1909, 1919, and 1929, respectively.

TABLE 2.—*Acreage of principal crops in Washington County, N. C., in stated years*

Crop	1879	1889	1899	1909	1919	1929
	Acres	Acres	Acres	Acres	Acres	Acres
Corn.....	15,824	13,695	15,394	12,532	13,070	10,137
Oats.....	1,065	1,856	741	527	478	54
Peanuts.....		649	3,442	4,687	3,915	6,608
Hay.....	13	70	505	1,263	2,275	6,661
Tobacco.....	4		36	6	344	1,630
Cotton.....	8,117	6,918	3,767	3,960	5,478	3,220
Potatoes.....		42	65	149	155	292
Sweetpotatoes.....	479	499	613	427	579	186

From table 2 it is observed that the acreage of peanuts, tobacco, potatoes, and hay crops has steadily increased, whereas that of corn,

oats, and sweetpotatoes has decreased. The cotton acreage dropped considerably between 1889 and 1909, after which there was an increase, but in 1929 the acreage was only 3,220 acres.

The use of commercial fertilizer is general, and most of it is bought ready mixed. In 1929, \$133,559 was spent for fertilizer on 959 farms, an average of \$139.27 a farm reporting. The grades in general use are 3-8-3,¹ 3-8-5, 5-8-6, 5-7-5, and 4-8-4.

Farm labor is plentiful and cheap. Most of the laborers are hired by the day, and they receive from 50 to 75 cents with board.

The farms range considerably in size, but most of them are between 10 and 100 acres. The average size in 1879 was 113 acres, and in 1929 it was 61.9 acres.

According to the 1930 census, 49.1 percent of the farms are operated by owners, 50.3 percent by tenants, and 0.6 percent by managers. The prevailing terms of rental are based on the share system, whereby the landlord furnishes the team, seed, plows, and one-half of the fertilizer, and he receives one-half of the crop. A few farms are rented for cash.

The farmhouses on the better farms are large, well constructed, and most of them painted. The average farm equipment consists of 1-horse plows, 2-horse plows, disk plows, riding plows, spike-tooth harrows, soybean harvester, cotton, corn, and peanut planters, peanut thresher, stalk cutter, and hayrakes. A few farmers have tractors and tobacco transplanters.

Most of the hogs are of the Duroc-Jersey and Poland China breeds, the dairy cows are Guernsey and Jersey, and the beef cattle are Aberdeen Angus and Hereford.

General farming land with good improvements may be bought at a moderate price. The price of flat, swampy, poorly drained land, as a rule, is governed by the quality and stand of timber. The selling price of peat land is variable, depending on location and drainage conditions.

SOILS AND CROPS

The soils and agriculture of Washington County are similar in many respects of those of several of the tidewater or lower coastal-plain counties of the State. Between 10 and 15 percent of the land in this county is under cultivation, and a very small acreage is in pasture. The extensive area of undeveloped land consists of a large area of peat comprising 92,928 acres, or 42 percent of the county. Practically all of Lakes Phelps and Pungo are in the county. Lake Phelps is the larger. The cut-over lands consist of some of the Bladen soils and a small percentage of the Craven and Lenoir soils. Most of the merchantable timber has been cut from the peat areas and areas of the other soils, except Bladen loam, Bladen clay loam, and swamp. Under present economic conditions, peat, swamp, and Portsmouth fine sand are suited only to forestry.

The soils of this county differ widely, in both physical and chemical composition, that is, they range from fine sands to heavy clays (in the mineral soils) and peat which is composed almost entirely of vegetable remains in various stages of decomposition. The mineral

¹ Percentages, respectively, of nitrogen, phosphoric acid and potash.

soils are derived through the soil-forming processes, such as aeration, drainage, and oxidation, from unconsolidated beds of fine sand and from sandy clays and clays. Peat and muck have been formed almost entirely through the growth and decay of sedges, reeds, and trees, which flourished in a swampy environment and finally decayed, forming deep deposits of vegetable matter.

The marked differences in the mineral soils are, in many places, due to drainage and aeration. Practically all of the lighter colored and lighter textured soils occur near Roanoke River and Albemarle Sound. Lying between these well-drained mineral soils and vast areas of peat and muck are extensive areas of flat, poorly drained mineral soils. In some places these soils contain a large quantity of organic matter. Some of them, particularly the Bladen and Hyde soils, are potentially the most fertile soils in the county, but because of poor drainage they are for the most part barred from crop production. When drained and reclaimed these soils are among the most productive for corn and soybeans.

The present-day agriculture of Washington County consists mainly of the production of peanuts, tobacco, and cotton, together with a small acreage devoted to potatoes, green peas, and tomatoes (as cash crops), and corn, soybeans, sweetpotatoes, and hay (as subsistence crops). Peanuts, tobacco, and cotton are grown because they insure the largest cash returns of the crops that can be produced under present economic conditions. They are the principal cash crops in North Carolina, and under normal conditions a fair return may be obtained from them. As these crops have been grown for a long time, both landlord and tenant know how to handle them under all climatic conditions. In the past the financial status of the county has depended on their production, and there has always been a ready market for them close to the field of production. Washington County is only a short distance from Suffolk, Va., the largest peanut market in the world. Transportation by railroad, autotruck, and water to convenient markets is available.

The coarse-textured well-drained soils occur in the northwestern part of the county. In addition to their texture and good drainage, the warm equable climate renders them admirably suited to the production of the main cash crops. The aggregate acreage devoted to truck crops is small, but a few farmers receive considerable revenue from their trucking operations. In a study of the changes in acreage of the main crops some interesting facts are revealed. For example, a few years ago cotton was selling at a good price, and the acreage at that time was almost double that of today. The reverse has occurred with peanuts, and even when peanuts are selling at a very low price the farmers are inclined to plant more of this crop than of cotton or tobacco, because a fair yield of peanuts can be obtained with no or very little fertilizer.

Corn occupies the largest acreage and is the most important crop grown. In the Wenona section a few farmers sell a small quantity of corn for cash, and the supply is sufficient to meet the local demand. Corn is used to feed livestock and to fatten hogs, and a small quantity is ground into meal for home consumption.

There is a considerable acreage of hay crops, and most of the hay is fed to work animals and cattle. A rather large number of hogs are sold annually. Most of the farmers turn their hogs into the soybean and peanut fields (after the peanuts are harvested) to graze, after which they are fed on corn for 2 or 3 weeks before marketing. Sweetpotatoes and other vegetables are grown for home use and to supply the curb market at Plymouth. A few pecan trees, peach trees, and Scuppernong grapevines are scattered throughout the northern part of the county. A few farmers near Albemarle Sound and Roanoke River supplement their income by fishing.

Throughout the county there is in general a direct relationship existing between the soils and the crops grown. This relationship can best be brought out by a grouping of the soils according to their characteristics which determine their capabilities for use as follows: (1) Light-colored well-drained soils, (2) light-colored poorly drained soils, and (3) black poorly drained soils.

An excavation in a soil reveals a series of layers, or horizons, called collectively the soil profile. The character of the profile, together with such general features as drainage, relief, and stoniness, determine how the soil is classified. The characteristics and properties of the soil taken into consideration by the soil survey are those that can be determined by simple tests in the field.

The three units used in field mapping of soils are series, type, and phase. Most important of these is the series which includes soils having essentially the same color, structure, thickness of the several horizons, relief, drainage, and approximately the same parent material. The series are given geographic names taken from the location in which the included soils were first recognized. The types within the soil series are named according to the texture of the surface soil, as sand, sandy loam, silt loam, or clay. The type name, added to the series name, gives the complete name of the type. A phase is a subdivision of a type, having characteristics worthy of recognition, yet not sufficiently different from the typical soil to justify the establishment of a new type. For example, in this county Norfolk is the name of a series, Norfolk fine sandy loam, the name of a type, and Norfolk fine sandy loam, deep phase, the name of a phase, or slight variation from the type.

In the following pages the soils of Washington County are described in detail, and their agricultural importance is discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Washington County, N. C.*

Type of soil	Acres	Per- cent	Type of soil	Acres	Per- cent
Norfolk fine sandy loam.....	6,464	2.9	Hyde loam.....	7,104	3.2
Norfolk fine sandy loam, deep phase.....	6,208	2.8	Bladen loam.....	21,184	9.5
Norfolk fine sand.....	4,608	2.1	Portsmouth very fine sandy loam.....	6,656	3.0
Craven fine sandy loam.....	9,024	4.1	Portsmouth fine sand.....	4,032	1.8
Ruston fine sandy loam.....	6,464	2.9	Muck.....	14,336	6.5
Lenoir very fine sandy loam.....	9,920	4.5	Muck, shallow phase.....	2,048	.9
Bladen very fine sandy loam.....	6,144	2.8	Peat.....	92,928	42.0
Bladen silt loam.....	10,816	4.9	Swamp.....	10,432	4.7
Bladen clay loam.....	3,072	1.4	Total.....	221,440	-----

LIGHT-COLORED WELL-DRAINED SOILS

The group of light-colored well-drained soils includes all the soils of the Norfolk, Craven, and Ruston series mapped in this county. The total acreage of these soils, is 32,768 acres, or 14.8 percent of the total area of the county. At least 75 percent of the land is under cultivation. Although they occupy a comparatively small acreage, these are recognized as the best developed soils in the county. The second-growth timber consists mainly of shortleaf pine, a few oaks, dogwoods, and maple and is accompanied by an undergrowth of myrtle and briars.

These light-colored well-drained soils are developed in the northern and northwestern parts of the county in close proximity to Albemarle Sound and Roanoke River. Their geographic position is well defined, as they occur on the breaks of the streams and on the undulating areas. They are by far the best drained soils in the county. Numerous small streams that have cut back into the areas and have cut rather deep channels are bordered by the more rolling areas. Because of their favorable surface relief, good drainage, and mellow friable consistence, improved farm machinery can be used to advantage. These soils are very easy to cultivate with hand tools and lend themselves more readily to the use of light-draft work animals and light farming implements than any other soils in the county.

All these soils have light-gray, grayish-yellow, or light-brown surface soils ranging from fine sands to fine sandy loams. In the Norfolk soils the subsoils range from yellow sands to yellow fine sandy clays, whereas the Ruston soil has a reddish-brown or brown fine sandy clay subsoil. The subsoil of the Craven soil is much heavier in texture, is plastic, and in most places becomes mottled within a depth of 3 feet. The fine sands contain sufficient clay to retain a large proportion of the rainfall, thus maintaining a good moisture condition for growing plants during normal periods of rainfall. Contrary to general belief the soils having more sandy subsoils withstand drought better than those with heavy clay subsoils, and they produce the best crops during ordinary dry seasons.

The light color of the surface soils indicates a low content of organic matter. These soils are leached of most of the soluble plant nutrients, but their physical properties are so favorable that they respond readily to fertilization. They warm up early in the spring and are the first in the county on which agricultural operations begin. Crops mature earlier on these soils. They are slightly acid in areas where lime has not been applied recently.

These soils produce all the tobacco, most of the truck crops, and a large percentage of the peanuts and cotton grown. Corn is grown indiscriminately on these soils, but yields are generally less than those on the heavier soils. When truck crops are in greater demand, there is no reason why their production on these soils should not be extended, as these are considered among the best soils for truck crops and peanuts from Maryland to Florida.

Norfolk fine sandy loam.—The 4- to 6-inch surface layer of Norfolk fine sandy loam in cultivated fields is gray fine sandy loam or loamy fine sand. It is underlain by grayish-yellow or pale-yellow,

loamy fine sand extending to a depth ranging from 12 to 18 inches. The subsoil is yellow, friable, and crumbly fine sandy clay to a depth ranging from 28 to 35 inches. This material is underlain by mottled light-gray, yellow, and reddish-brown fine sandy clay material. In places where drainage is not good, the subsoil shows slight mottlings of light gray or almost white at a depth of about 28 inches.

In wooded areas the first 1 to 3 inches of the surface soil contain enough organic matter to give the soil a dark-gray or grayish-brown color. Below this layer is grayish-yellow or pale-yellow loamy fine sand extending downward to the yellow fine sandy clay. In the extreme western part of the county are a few small areas, in which the surface soil is gray loamy fine sand to a depth of 3 or 4 inches, and this material grades into light-brown loamy fine sand. The subsoil is yellow friable fine sandy clay. In places where areas of Norfolk fine sandy loam adjoin areas of Craven fine sandy loam the subsoil is heavier than the representative areas of the Norfolk soil, and mottlings appear near the surface. On some slopes the yellow fine sandy clay subsoil layer is shallow or in places exposed. In still other areas the covering of loamy fine sand over the fine sandy clay is deeper and approaches Norfolk fine sandy loam, deep phase, or grades toward Norfolk fine sand.

This soil occurs in the extreme northern end and western parts of the county. The largest area lies southwest of Mackeys, large areas occur south and west of Roper, and a fair-sized area is west of Hinson along the Martin County line.

This soil has an almost level or undulating to gently sloping surface relief. Natural drainage for the most part is good, but some of the more level areas are benefited by artificial drainage.

This is considered the best soil in the county for the production of bright tobacco, peanuts, and truck crops, and these are the chief crops grown, with some cotton, sweetpotatoes, May peas, oats, corn, soybeans, and garden vegetables. The greater part of the land is under cultivation. About 50 percent of the cultivated soil is devoted to peanuts, 15 percent to tobacco, 15 percent to cotton, and 20 percent to the other crops mentioned. Peanuts yield from 40 to 100 bushels an acre, tobacco from 600 to 1,000 pounds, and cotton from one-third to 1 bale.

Peanuts receive, as a rule, about 300 pounds of land plaster at blooming time, and a few farmers use a small quantity of commercial fertilizer at planting time. Tobacco receives from 700 to 1,000 pounds of 3-8-3, 3-8-5, or 3-8-6 fertilizer an acre; cotton from 200 to 600 pounds of 3-8-3, 4-8-4, or 5-7-5, with 75 or 100 pounds of nitrate of soda or sulphate of ammonia as a top dressing; and corn from 100 to 300 pounds of 3-8-3 or 4-8-4, with about 75 pounds of nitrate of soda as a top dressing. The available stable manure is used on all crops. All truck crops receive, as a rule, a large acre application of a high-grade commercial fertilizer.

Norfolk fine sandy loam is a well-drained, mellow, and easily cultivated soil, but it contains a very small proportion of organic matter. This soil is benefited by growing and turning under leguminous crops, such as soybeans, cowpeas, crimson clover, vetch, and rye. It responds readily to applications of barnyard manure and commercial fertilizers.

Norfolk fine sandy loam, deep phase.—Norfolk fine sandy loam, deep phase, occurs in close association with Norfolk fine sandy loam, Norfolk fine sand, and Ruston fine sandy loam. The deep phase differs from typical Norfolk fine sandy loam, in that it has deeper, lighter textured, and lighter colored loamy fine sand overlying the fine sandy clay subsoil which is reached between depths of 25 and 35 inches. Included with this deeper soil in mapping are spots of Norfolk fine sand and small areas of Norfolk fine sandy loam. In places where Norfolk fine sandy loam, deep phase, joins Ruston fine sandy loam, the profile has a brown cast throughout.

Norfolk fine sandy loam, deep phase, occurs in the northern and western parts of the county. The largest areas are west of Ausbon, southeast of Plymouth, between Plymouth and Roper, south of Albemarle Sound, and between Bull Creek and Deep Creek. The land has an undulating, almost level, or gently sloping surface relief and is everywhere well drained. Areas of this soil are used for the production of the same crops as those grown on Norfolk fine sandy loam, and they are fertilized in the same manner, but crop yields are slightly lower. The deeper soil is a good soil for early truck crops, bright-leaf tobacco, and peanuts. It is not a strong soil and cannot be built up and maintained in so high a state of productivity under similar treatment as Norfolk fine sandy loam, but it is a much better soil than Norfolk fine sand.

Norfolk fine sand.—Norfolk fine sand occupies a small acreage. The largest areas lie south of Albemarle Sound in the vicinity of Reas Beach and on Pea Ridge at Leonards Point. A few smaller areas are scattered throughout the western end of the county. The surface relief is undulating or gently sloping, and the land is exceptionally well drained.

To a depth ranging from 5 to 8 inches, in cultivated fields the surface soil is light-gray or yellowish-gray fine mellow sand. It is underlain by pale-yellow or yellow loose mellow fine sand continuing downward to a depth ranging from 40 to 50 or more inches, where it is underlain, in most places, by light-gray fine sandy clay material mottled with brown. In forested areas the first few inches of the fine sand contain enough organic matter to give it a grayish-brown appearance. In places there is a brown-stained layer several inches thick.

About 50 percent of this soil is under cultivation, and the rest is forested with old-field pine, together with a few blackjack oaks. The land is very easy to cultivate and can be cultivated immediately after a rain. Only light farming implements need be used. The soil is deficient in organic matter, and fertilizers and manure leach out of the fine sand very quickly. This soil is used mainly for the production of corn, light truck crops, and peanuts, and a small acreage is devoted to tobacco. Sweetpotatoes do well. Under ordinary conditions yields of all crops are less than those obtained on Norfolk fine sandy loam, deep phase, or Norfolk fine sandy loam, but they vary according to the quantity of fertilizer applied. The turning under of green-manure crops or applications of barnyard manure are very beneficial. This fine sand, because of its texture and open porous structure, leaches badly, and it is difficult to build up and maintain in a productive condition.

Craven fine sandy loam.—The surface soil of Craven fine sandy loam is pale-gray or yellowish-gray fine sandy loam to a depth of 4 or 6 inches, underlain by pale-yellow rather heavy fine sandy loam or loamy fine sand, which extends to a depth ranging from 7 to 10 inches. The subsoil, which extends to a depth ranging from 20 to 25 inches, is yellow or pale-yellow heavy clay or heavy sticky fine sandy clay. This material is underlain by yellow, mottled with steel gray and reddish brown, tough plastic clay which continues to a depth of 60 or more inches. The material in both the subsoil and the underlying layer cracks and breaks into irregular-shaped lumps on drying.

Included with mapped areas of Craven fine sandy loam are a few areas which have a yellowish-brown clay or heavy fine sandy clay subsoil overlying the mottled substratum. In a few places, particularly in areas of more sloping surface relief, surface erosion has removed part of the fine sandy loam covering, leaving a very shallow surface soil.

This soil occurs in rather large areas south of Plymouth, in the vicinity of Roper, and between Roper and Mackeys. Smaller areas are scattered throughout the northwestern and northern parts of the county. The surface relief is undulating or gently sloping, and natural surface drainage ranges from fair to good. Open ditches are necessary on the more level areas. Internal drainage is hindered because of the heavy character of the subsoil which does not allow free circulation of air and water.

At least 65 or 70 percent of the land is under cultivation. The main crops grown are peanuts, tobacco, cotton, and corn, with some potatoes, oats, soybeans, and May peas. About 50 percent of the cultivated land is devoted to peanuts, 12 percent to tobacco, 20 percent to cotton, and 18 percent to the other crops mentioned.

The fertilizer treatment, crop yields, and crops grown on this soil are about the same as those on Norfolk fine sandy loam. The Craven soil does not warm up so early in the spring or drain out so readily as the Norfolk soil, but it is one of the important agricultural soils. It can be built up to a fair state of productivity, as the heavy subsoil retains manures and fertilizers well.

Ruston fine sandy loam.—The surface soil of Ruston fine sandy loam is gray-brown or grayish-yellow fine sandy loam to a depth of 6 or 8 inches, underlain by grayish-yellow or brownish-yellow mellow fine sandy loam which extends to a depth ranging from 12 to 16 inches. The subsoil, which continues to a depth ranging from 35 to 40 inches, is reddish-brown or yellowish-brown friable crumbly fine sandy clay of uniform structure and color. This material is underlain by yellow or brownish-yellow slightly sticky fine sandy loam. In a few places the subsoil is reddish-brown heavy fine sandy clay. A few areas of Ruston fine sandy loam, deep phase, are included with mapped areas of this soil.

Ruston fine sandy loam occurs for the most part in the northwestern part of the county, in close association with the Norfolk and Craven soils. The largest areas lie in the vicinity of Plymouth and northeast of that town, and fair-sized areas are east of Mackeys along Albemarle Sound and north of Roper.

This soil is developed in areas of undulating to sloping surface relief, in most places in close proximity to natural drainageways. All the land is naturally well drained, owing to its favorable surface relief and to the texture and friability of both surface soil and sub-soil. From 35 to 40 percent of the land is under cultivation, and the rest is forested to old-field pine, together with a few hardwoods. This is one of the good agricultural soils of the county and is used mainly for the production of peanuts, corn, cotton, garden vegetables, and truck crops and to some extent for tobacco. It is fertilized in about the same way and the yields obtained are about the same as those on Norfolk fine sandy loam. It warms up quickly in the spring and is easy to cultivate. It can be built up to a fair state of productivity through the incorporation of organic matter or the addition of barnyard manure.

LIGHT-COLORED POORLY DRAINED SOILS

The light-colored poorly drained soils comprise 29,952 acres, or 13.6 percent of the county. This group includes Lenoir very fine sandy loam and several types of the Bladen series. These soils occupy a position between the light-colored well-drained soils and the vast areas of muck and peat, and they extend from the southwestern corner of the county around through the northern part, and are also developed in large areas in the extreme eastern part. The surface relief over the greater part of their area is flat or almost level, but parts of the areas occupied by the Lenoir soils are undulating or gently rolling.

The more extensive areas, especially those of the Bladen soils, are naturally poorly drained on the surface and in the subsoil. The poor internal drainage is owing to the heavy character of the subsoil and to a comparatively high water table. Extensive areas of these soils have not been invaded by natural drainageways. All the soils which are or have been cultivated have been drained artificially by canals and open ditches, which are essential in the reclamation of these soils for agricultural purposes. The walls of the ditches stand up exceptionally well and are enduring because of the heavy tough character of the clay subsoil.

The soils of this group range from light gray to dark gray and contain only a small quantity of organic matter. All the soils of the group are darker and are heavier in texture than the soils of the first group. The subsoils are mottled or streaked, and in many places some are of uniform steel-gray color, which indicates lack of aeration and only partial oxidation of the iron salts. All these soils are acid.

About 20 percent of the land occupied by these soils is under cultivation. By far the largest areas of the Bladen soils are in the eastern part of the county, in the vicinity of Creswell.

Most of the original timber growth has been removed, but there are fair-sized black gum, shortleaf pine, white oak, red oak, post oak, and maple, together with some dogwood, hickory, holly, and other trees of minor importance. The undergrowth consists of cane, or so-called "reeds", and gallberry. In some places the merchantable timber is being cut.

The principal crops grown on these soils are corn and soybeans, with some cotton, peanuts, and potatoes. Although cotton and peanuts are grown to some extent, these soils are not so well suited to the production of these crops as are the light-colored well-drained soils. As the farmer needs a cash crop, however, and cotton and peanuts meet this demand better than any other crop, with the exception of potatoes, he plants these crops wherever possible. The soils of this group do not warm up so early in the spring as those of the first group, and they cannot be cultivated so soon after rains. Crops are late in maturing, but the long growing season is favorable to them.

Lenoir very fine sandy loam.—The 5- or 7-inch surface layer of Lenoir very fine sandy loam, in cultivated fields, is gray very fine sandy loam which passes into grayish-yellow, mottled in places with brownish yellow, heavy very fine sandy loam extending to a depth ranging from 6 to 9 inches. The subsoil, to a depth ranging from 30 to 35 inches, is mottled gray, yellow, and reddish-brown heavy tough clay or silty clay, which is plastic and sticky when wet but on drying cracks and breaks into irregular-shaped hard lumps. This material is underlain by light-gray, streaked with yellow, rather heavy sticky silty clay or fine sandy clay. Included with this soil in mapping are small areas of Lenoir fine sandy loam and a few areas in which the surface soil resembles that of Norfolk fine sandy loam. Locally the surface covering of very fine sandy loam is shallow over the heavy subsoil material.

Lenoir very fine sandy loam is well distributed throughout the northeastern, northern, and northwestern parts of the county. Some of the largest areas are south of Plymouth, southeast of Mackeys, and south of Deep Creek, and many smaller areas lie in the vicinity of Creswell, Cherry, and northeast of Beasley.

The surface relief ranges from almost level to undulating. Natural surface drainage ranges from fair to poor. On the more level areas water remains after heavy rains, because it cannot easily penetrate the heavy subsoil. Open ditches are necessary to drain this land for best agricultural use. This soil does not warm up so quickly in the spring as Norfolk fine sandy loam or Craven fine sandy loam. Because of its fine texture it has a tendency to pack and clod when dry and to run together when wet. This condition can be corrected in large measure by the incorporation of organic matter.

A fairly large percentage of this soil is under cultivation, mainly to peanuts, cotton, corn, oats, soybeans, and a few truck crops. About 40 percent of the cultivated acreage is devoted to peanuts, 20 percent to cotton, 20 percent to corn and soybeans, and 20 percent to the other crops mentioned. Peanuts yield from 35 to 75 bushels an acre, cotton one-fourth to three-fourths bale, and corn 15 to 35 bushels. The quality of peanuts grown on this soil is not quite so good as of those grown on the Norfolk and Craven soils.

All crops are fertilized to more or less extent. Cotton receives from about 200 to 500 pounds to the acre of 3-8-3 or, in some places, 4-8-4, and a few farmers give this crop a side dressing of 75 or 100 pounds of nitrate of soda or sulphate of ammonia. Corn receives less of the regular fertilizer and is usually given about 75

pounds of nitrate of soda as a top dressing. Peanuts are generally given a small quantity of commercial fertilizer at planting time and about 300 pounds of land plaster at blooming time. This soil, like all other light-colored soils of the county, is naturally deficient in organic matter. It would be improved by the incorporation of green-manure crops and barnyard manure, and lime would be beneficial for most of the crops grown.

Bladen very fine sandy loam.—The surface soil of Bladen very fine sandy loam in cultivated fields consists of a 4- to 6-inch layer of gray or brownish-gray very fine sandy loam underlain by light-gray, in places slightly mottled with rust brown, very fine sandy loam which extends to a depth ranging from 10 to 15 inches. The subsoil is steel-gray, streaked with yellowish brown or ocherous colored, very fine sandy clay or plastic clay. In a few places the very fine sandy loam covering over the subsoil ranges from 15 to 24 inches in thickness. In places where the soil has been in clean-cultivated crops for a long time, the surface soil to the depth of cultivation is light gray. In a few places the surface soil is fine sandy loam, and in places where this soil borders Bladen silt loam, the surface soil is finer in texture. In wooded areas, the topmost 1- to 3-inch layer of the soil contains a considerable quantity of organic matter.

Bladen very fine sandy loam occurs in several fair-sized areas in the extreme eastern part of the county. Some of the largest bodies are northeast of Creswell, south of Cherry, and south of Davenport Forks. This soil has flat, almost level surface relief and is naturally poorly drained. Artificial drainage is necessary for its reclamation for agricultural purposes.

About 80 percent of the land is under cultivation, and the main crops are corn, soybeans, and cotton. A small acreage is in peanuts and potatoes. About 50 percent of the land in cultivation is devoted to corn and soybeans, 30 percent to cotton, and 20 percent to peanuts and truck crops. Corn yields from 25 to 35 bushels an acre where an application ranging from 300 to 400 pounds of a 3-8-3 or 4-8-4 fertilizer and 75 or 100 pounds of nitrate of soda as a top dressing are used; and cotton yields from one-half to 1 bale, with from 300 to 600 pounds of 4-8-4 or 3-8-3 and 100 pounds of nitrate of soda or sulphate of ammonia as a top dressing. Peanuts do not produce well on this type of land.

Bladen silt loam.—The largest and most continuous areas of Bladen silt loam lie in the vicinity of Scuppernong, north of Creswell, east and south of Beasley, along the Norfolk Southern Railroad, and between Beasley and Mackeys. Some fair-sized areas are south and west of Roper, and one is along the Hyde County line south of Wenona.

The surface layer of Bladen silt loam, to a depth of 5 or 7 inches, ranges in color from dark gray in forested areas to light gray in areas which have been cultivated for a long time. This material is underlain by light-gray heavy silt loam or silty clay loam, extending to a depth ranging from 10 to 14 inches. The subsoil is steel-gray, mottled or streaked with yellowish brown or ocherous colored, heavy plastic clay or silty clay, extending downward to a depth ranging from 4 to 5 feet, below which the color is more uniformly light gray or steel gray and contains fewer mottlings.

This soil has flat, almost level surface relief and is naturally poorly drained. The areas under cultivation have been artificially drained by canals and open ditches.

Bladen silt loam is an important agricultural soil in this county, and much of it has been under cultivation for a long time. Probably from 40 to 50 percent of it is now under cultivation. It is a good, strong, agricultural soil and is used mainly for the production of corn, soybeans, and cotton. Crop yields and the fertilizer treatment practiced on this soil are similar to those on Bladen very fine sandy loam. Because of its slightly heavier texture, this soil is not quite so easy to cultivate as Bladen fine sandy loam, but it can be built up to a high state of productivity through the incorporation of green-manure crops and barnyard manure.

Bladen clay loam.—The 8- or 10-inch surface soil of Bladen clay loam consists of gray, or gray with rust-brown mottlings, clay loam. It is underlain by gray heavy plastic clay mottled and streaked with brown or ocherous yellow. In places the surface soil is silty clay loam or clay.

This soil occurs in several scattered areas in the western, northern, and eastern parts of the county. Some of the largest bodies are in the southwestern part, bordering the large area of muck. Smaller areas are east of Plymouth and west of Creswell.

This soil has flat, level surface relief or occurs in slight depressions. It is everywhere very poorly drained, and water stands on the surface during rainy seasons. Nearly all the land is in forest, except a small part which is devoted to pasture.

BLACK POORLY DRAINED SOILS

This group includes all the black poorly drained soils in the county, that is, all the Hyde and Portsmouth soils, Bladen loam, muck, peat, and swamp. The combined area of these soils is 158,720 acres, or 71.6 percent of the total area of the county. They occur in an extensive and unbroken area in the south-central, southeastern, and southern parts, occupying flat almost level positions. They are all naturally poorly drained and prior to the establishment of artificial drainage were in a swampy or semiswampy condition. An extensive drainage system of wide deep canals over a large part of this section was established about 19 years ago. Some of the canals are 1 mile apart and others only one-half mile. The water table is everywhere near the surface, but it fluctuates according to the amount of rainfall. These soils cannot be cultivated until they have been drained.

There are two classes of soils in this group—(1) Hyde loam, Bladen loam, Portsmouth fine sand, and Portsmouth very fine sandy loam and (2) muck, peat, and swamp. Bladen loam has a very dark surface soil containing a large quantity of organic matter. The Hyde and Portsmouth soils are mainly mineral soils which have a high content of organic matter in the upper part of the profile, that is, to a depth ranging from 10 to 30 inches. The subsoils are mottled yellow and gray sandy clay or drab silty clay. The Hyde soils are differentiated from the Portsmouth soils, in that they contain more organic matter, have a much thicker surface soil, and are more closely associated with muck and peat. The Hyde soils constitute

some of the most productive lands in eastern North Carolina and are especially adapted to corn and soybeans. They occupy only a small proportion of the land in this group. Muck, peat, and swamp are principally organic soils or materials composed of more or less decomposed vegetation and containing only a small amount of mineral matter. In some places swamp is a mineral soil, and in other places it is simply a mixture of mineral and organic material. Peat, which occupies 42 percent of the land in Washington County, is by far the most extensive classification. With the exception of a small area around Wenona, none of the peat land is under cultivation.

Hyde loam.—Hyde loam, to a depth ranging from 20 to 30 inches, is black or brownish-black loam carrying a high percentage of silt and a large quantity of well-decomposed organic matter. The subsoil is drab or drabbish-brown, in places faintly mottled with rust brown, silty clay which continues downward to a depth of 4 feet or deeper.

This soil occurs in fairly large bodies in the southern and extreme eastern parts of the county, the largest individual areas lying between Creswell and Lake Phelps, along the three main canals in that locality. A fair-sized area lies south of Wenona. Natural drainage is poor, but the greater part of the land is included in drainage districts and is traversed by large canals from one-half to 1 mile apart.

This is an important agricultural soil, and about 65 percent of it is cultivated. Corn is the only crop extensively grown. This is considered the best corn soil in eastern North Carolina. A few acres are devoted to potatoes, cotton, rye, and oats. Vegetables are produced for home use. Soybeans are planted with corn. Yields of corn range from 30 to 60 bushels an acre, without fertilizer, and yields of soybeans are good. Lime and small applications of muriate of potash have proved very beneficial.

Bladen loam.—Bladen loam differs from the other Bladen soils in that it has a loamy texture and the color of the material in the topmost 6 to 12 inches is dark gray or almost black. The color is caused by the high content of organic matter. After the land has been cultivated for several years, a large part of the organic matter is dissipated and the surface soil becomes dark gray or gray. The subsoil is similar in color, texture, and structure to the subsoil of Bladen silt loam.

There are three large areas of Bladen loam in the county—one lying south and east of Ausbon, one southwest and west of Roper, and the third along the Norfolk Southern Railroad between Beasley and Scuppernong. Fair-sized areas lie about 4 miles northeast of Roper and about the same distance northwest of that town, and smaller areas are in the western and northern parts of the county. Many small bodies are north of Lake Phelps.

Bladen loam occupies flat level areas or slight depressions, and in some places the land is in a semiswampy condition. It is naturally poorly drained, and it requires artificial drainage before it can be successfully cultivated. Most of it is forested, and only a small proportion has been reclaimed and put under cultivation.

Yields of corn and soybeans are good and are slightly higher than those obtained on the other Bladen soils. This soil is espe-

cially suited to the production of potatoes and soybeans, and cabbage does well. Cotton, when properly fertilized to produce fruiting and not too rank a growth of stalk, also does well.

Portsmouth very fine sandy loam.—The 6- to 10-inch surface layer of Portsmouth very fine sandy loam consists of dark-gray or black very fine sandy loam high in organic matter. It is underlain by light-gray, stained with brownish yellow, fine sandy loam which continues to a depth of about 15 inches. The subsoil is gray or mottled gray and yellow friable sticky fine sandy clay extending downward to a depth of 3 feet or deeper. Included in mapped areas of this soil are a few bodies that have a brown-stained layer just beneath the surface soil.

This soil occurs in several large areas, mainly in the extreme western and eastern parts of the county. Some of the largest are in the vicinity of Emandell, south of Ausbon, southeast of Plymouth, and south of Creswell along the Tyrrell County line.

Practically all the Portsmouth very fine sandy loam in this county is forested. This is a good agricultural soil where drained and limed, and it produces good yields of corn, soybeans, cotton, oats, and truck crops.

Portsmouth fine sand.—The surface soil of Portsmouth fine sand ranges from dark-gray to black fine sand which continues downward to a depth ranging from 8 to 20 inches. The sand contains a large quantity of organic matter which gives it a loamy feel. It is underlain by light-gray fine sand which extends downward to a depth of 3 feet or deeper and rests on mottled light-gray or rust-brown fine sandy clay material. Included with mapped areas of this soil are a few small bodies of light-gray or gray fine sand, which are similar to Plummer loamy fine sand. Such areas are somewhat better drained than Portsmouth fine sand. In places Portsmouth fine sand is mucky or peaty in the surface soil.

Portsmouth fine sand is one of the inextensive and unimportant soil types in this county. It occurs in the so-called "bays" or in slight depressions in the extreme western part, east and south of Hinson, and in the eastern part southeast of Roper and east of Creswell. The land is naturally poorly drained and remains in a saturated condition during a part of the year. In its present condition this soil can best be used for forestry. None of it is cleared or farmed.

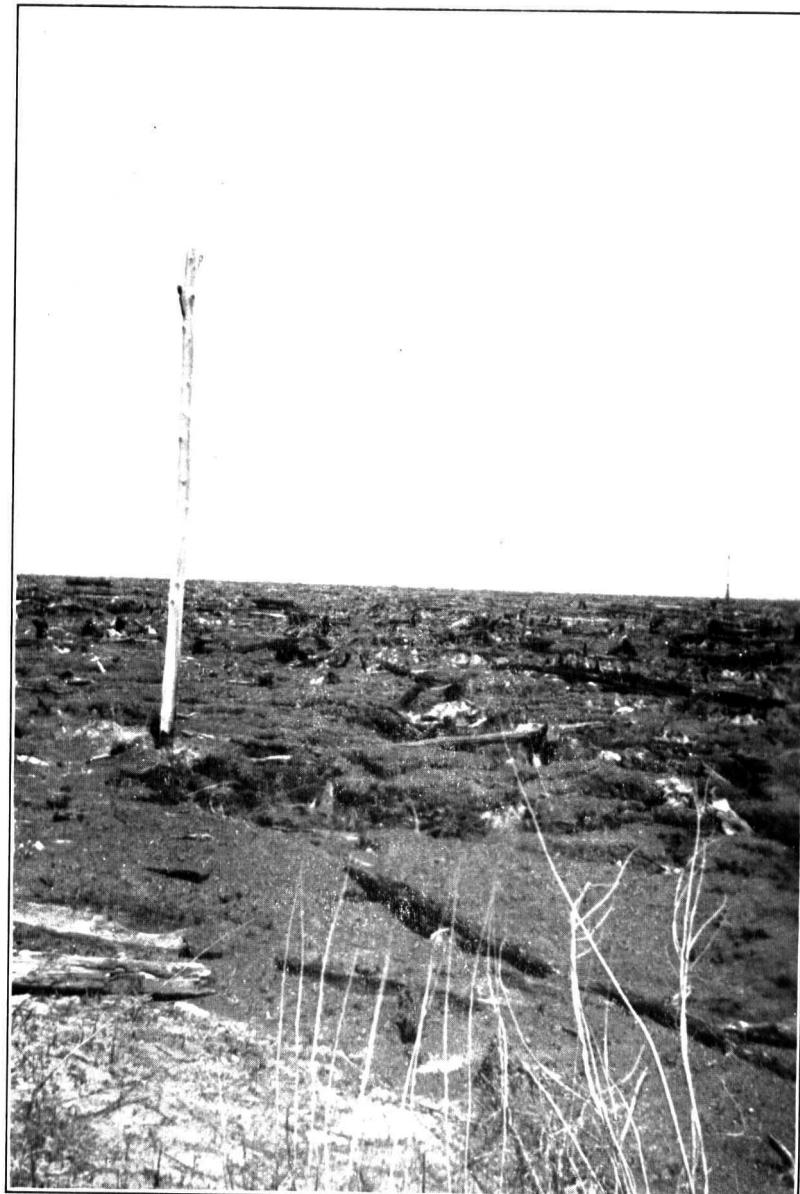
Muck.—Muck consists of well-decayed vegetable matter mixed with varying proportions of fine mineral matter. The well-decomposed vegetable matter, together with the mineral matter, gives the muck considerable body and a smooth slick feel. The material is black or very dark brown and ranges in thickness from 2 to several feet. It is underlain by gray sticky fine sand or fine sandy clay. In places there is a 3- or 4-inch surface layer of brown or black peat.

Muck occurs in long, continuous, and rather broad areas lying between the mineral soils and the large area of peat. The largest body of muck is in the western part of the county about 5 miles southeast of Plymouth. Large bodies lie south of Beasley, north of Lake Phelps, and along Thirty-Foot Canal.

This land is poorly drained and at present is not used for agriculture. Practically all of it is forested, and until it is drained and reclaimed for agricultural purposes, forestry is the best use for it.



Profile of a peat area near Wenona. Note the buried log from a former forest.



Burned-over area of peat near Wenona.

Where drained and limed, fair yields of corn can be obtained for a few years.

Muck, shallow phase.—Muck, shallow phase, is rather granular black muck to a depth of 5 or 7 inches. Some ashes occur in places where the muck has been burned over. Underlying this material is brown finely divided peat which extends to a depth ranging from 12 to 16 inches, and below this and continuing to a depth ranging from 16 to 28 inches, is black sticky muck. Underlying this material, in turn, is drab or brownish-drab rather stiff and smooth silty clay, in fact, the same material as that underlying Hyde loam.

In a few places the muck, to a depth of 4 inches, is black, and it is underlain by brown fibrous peat extending to a depth of 28 or 30 inches. Below this, and continuing to a depth of about 36 inches, is black sticky muck underlain by drab or brownish-drab clay or silty clay. No sharp line of demarcation exists between shallow muck and Hyde loam on one side and muck or, more generally, peat on the other.

The only area of this shallow muck mapped is in the southern part of the county. The Blackland Branch Experiment Station, near Wenona, is on this soil. When this station was established the muck, that is, the part above the silty clay, was approximately 4 feet thick, and now, after 17 years of cultivation, in most places, it is little more than 2 feet thick. Most of the subsidence occurs during the first 3 or 4 years of cultivation. Logs scattered and buried throughout the muck interfere with cultivation.

The principal crop grown on this shallow muck is corn planted with soybeans. A few acres are devoted to potatoes and oats. With 1 or 1½ tons of lime an acre applied every 3 years and 75 pounds of muriate of potash every year, from 40 to 60 bushels of corn can be produced. A few farmers obtain fair yields without fertilizer. Next to lime, applications of potash have proved to be, especially after cropping for a few years, most beneficial in increasing the yields of corn, oats, and potatoes.

The North Carolina Agricultural Experiment Station, State College Station, Raleigh, N. C., has further information on this kind of soil.

Peat.—A representative profile of peat may be described as follows: The topmost 2- or 3-inch layer is black granular peat consisting of well-decomposed organic matter, together with a large quantity of small hard angular burned particles. Underlying this material and continuing to a depth ranging from 10 to 15 inches is brown peat, in which the organic matter is fairly well decomposed. The material in this layer cracks on drying and apparently runs together and forms a layer almost impervious to water when wet. Below this layer and extending to a depth of 48 inches is brown fibrous soft felty peat containing many small roots and partly decomposed blades of vegetation. Between depths of about 48 and 56 inches the material is black sticky slightly plastic finely divided well decomposed organic matter containing a noticeable quantity of silt or clay. Underlying this at a depth of about 60 inches is gray or almost white sticky fine sand or fine sandy clay material. Near the surface and particularly at a depth ranging from about 2 to 3 feet below the surface there are many fairly well preserved logs.

As mapped in Washington County, peat varies considerably from place to place, as regards depth, color of the material, and structure of the different layers. In many places it grades into muck or Hyde loam. The peat along Roanoke River and west of Bull Bay is shallower than that in the central part of the county. In places where the peat land has been burned over recently, some brown or reddish-brown ash is on the surface and also small angular particles of charcoal, which give the upper part of the material a granular structure. The black peat is developed for the most part in the better drained areas, whereas the more fibrous felty brown peat occurs in areas which are saturated or covered with water.

Near Pungo Lake the topmost 1- or 2-inch layer of peat consists of loose forest litter derived largely from leaves or twigs of red gum, maple, and other deciduous trees. Beneath this and continuing downward to a depth ranging from 12 to 16 inches is reddish-brown or grayish-black finely divided organic matter which is sticky when wet. This material cracks on drying and generally breaks along angular fractures. Underlying this denser organic material is a layer of more fibrous organic matter which appears to have been developed from the decay of the former swamp forest of cedar, pine, gums, and cypress. Beneath this and extending to a depth of 60 inches is a layer of dark grayish-brown sedimentary fibrous material. In the lower part of this layer, the percentage of mineral matter, such as silt and clay, is relatively high compared with that in the layers already described. The peat in this area appears to have been derived from grasses and trees. There have been at least two forest growths, and these were preceded by a growth of reeds and grasses. The decay of these plants, together with the decay of the tree vegetation, explains the differences in the character of the material in the different layers in the profile. The presence of logs at a depth ranging from 2 to 3 feet below the surface indicates a former forest growth of extremely large trees (pl. 1). After the decay of the forest growth, there were probably grasses and reeds over this area, and these were followed by the present forest growth. The original tree growth was chiefly maple, ash, sweetgum, cypress, and juniper (or white cedar). There is some underbrush consisting of briars, vines, and reeds, and holly, myrtle, and bay bushes. The local variations throughout the peat profile occurring in this vast area are referred to as juniper peat, cypress peat, or black-gum peat.

Peat occurs for the most part in one vast continuous area in the southeastern, southern, central, and southwestern parts of the county. Fair-sized bodies are in the extreme northeast corner between Albemarle Sound and Bull Creek and along Deep Creek. There is a large body in the extreme northwest corner at the mouth of Roanoke River. Peat is almost continuous along the Hyde and Beaufort Counties lines, and at Pungo Lake it extends northward for a distance of about 10 miles. Situated within the peat areas are Lake Phelps and the greater part of Pungo Lake.

The surface of the peat land is flat or almost level, with a slight gradient in many places toward the outer border of the areas. Natural drainage is poor, but a large acreage in the southern part of the county, in the locality of Wenona, is included in drainage districts

traversed by large canals from one-half to 1 mile apart. In places where drainage has been established and the water table lowered, the surface becomes dry and the peat is burned over after a period of several years, to a depth ranging from 2 to 3 feet. In dry seasons fires occur that burn the organic matter to the water level, thereby destroying all vegetation and leaving exposed stumps and roots of an earlier forest (pl. 2).

Only a very small percentage of the peat land in Washington County has been farmed, and the cultivated areas are in the vicinity of Wenona. The principal crop is corn which, for a few years, yields from 30 to 50 bushels an acre with applications of lime and potash. It is reported that the yields decline year after year. Most of the peat land in eastern North Carolina is agriculturally poor because of the low content of plant nutrients, such as are generally present in a good mineral soil. The peat, for the most part, is strongly acid and has an excessive content of moisture. Although there is a large content of organic matter, it has not been converted into nitrogen and is not, for the most part, in available form for plants. It is difficult to control the moisture, that is, to maintain the water table at a proper level. On cultivation, peat will shrink and pack down. The greater part of the settling is done within a period ranging from 3 to 5 years. When the ground settles, the numerous buried logs and stumps, which appear on the surface and at slight depths beneath, interfere with cultivation.

A large part of the peat land is forested, especially where it has not been farmed or recently burned over and the trees killed. The tree growth consists of a mixed forest of cypress, tupelo, and white cedar, together with some ash, white bay, and red bay. In the wetter areas, cypress and black gum are the principal trees, and in such areas the presence of standing water accounts for the scarcity of under-growth of shrubs and smaller herbaceous plants.

Under present economic conditions, the peat deposits constitute marginal or submarginal land for agricultural uses. They are valued largely on the basis of the quality and stand of merchantable timber. The peat land, therefore, should be utilized for forests or for bird and game refuges. It should possibly be saved in the interest of scientific research directed toward the study of conservation of resources of raw materials for future industries.

Swamp.—Swamp as mapped in Washington County, represents stream-bottom areas, in which the soil material varies considerably in texture, structure, and color. These areas are either covered with water or are in a swampy condition the greater part of the year. The surface soil ranges in texture from loam, silt loam, or silty clay loam to fine sand or fine sandy loam. The subsoil may be fine sand, fine sandy loam, silty clay, or clay, ranging in color from gray to mottled gray and brown. In some places the topmost 2- or 3-inch layer is black mucky loam or peaty muck, and in some places swamp is merely brown peat.

Swamp occurs along practically all of the natural drainageways and in the northeastern part of the county in areas where drainage has not been established. The largest bodies are along Scuppernong River, near the headwaters of Bull and Deep Creeks, and south of Albemarle Sound. Narrow strips lie along the streams in the northern and western parts of the county.

All the swamp lies at a very low elevation and is covered with water all or the greater part of the year. Under present conditions the best use for this land is forestry, as reclamation of it would not be practical. The principal tree growth includes cypress and gums.

RECOMMENDATIONS FOR IMPROVEMENT OF WASHINGTON COUNTY SOILS*

In table 4 recommendations made by the North Carolina Agricultural Experiment Station for the use of fertilizer for the major crops grown on the leading soils of Washington County are given. The quantities are acre applications.

TABLE 4.—*Recommendations for the use of fertilizer for the leading crops on the principal soils of Washington County, N. C.*

Soil type	Fertilizer recommended for—			
	Peanuts	Tobacco	Corn	Cotton
Lenoir very fine sandy loam.	200 to 300 of 2-8-4.	-----	300 to 400 of 4-8-4	500 of 4-10-4.
Craven fine sandy loam.	-----do-----	700 to 800 of 3-10-6.	300 to 400 of 4-6-4 with side application of 50 to 65 of nitrate of soda or sulphate of ammonia if needed.	500 of 4-10-4 and 50 to 100 of nitrate of soda or sulphate of ammonia after first chopping.
Norfolk fine sandy loam.	-----do-----	800 to 1,000 of 3-8-6.	300 to 400 of 4-6-4 with side application of 50 to 75 of sulphate of ammonia when corn is knee-high if needed.	500 to 600 of 4-8-4 and 50 to 100 of nitrate of soda or sulphate of ammonia after first chopping.
Buston fine sandy loam.	-----do-----	-----do-----	300 to 400 of 4-8-4 and 50 to 75 of sulphate of ammonia or nitrate of soda when corn is knee-high if needed.	Do.
Bladen silt loam.....	200 of 8-1½-4.	-----	300 to 400 of 4-8-4	500 of 4-10-4.

In addition to the commercial fertilizer, about 300 pounds of gypsum on the leaves at blooming time is recommended for peanuts.

On all the soils listed in table 4, the use of a fertilizer mixture analyzing 5-7-5 in applications ranging from 1,600 to 2,000 pounds an acre is recommended for potatoes. Not less than one-third of all the ammonia contained in the fertilizer mixture should be derived from some high-grade organic material, such as cottonseed meal, tankage, or fish scrap, and the rest may be derived from sulphate of ammonia, nitrate of soda, or a mixture of the two. The potash should be derived from muriate of potash or sulphate of potash.

Most of the soils in this county probably need lime, but the quantity to be applied should be based on an acidity test of the soil. As a

* The following list of publications is appended for reference for persons desiring more detailed information that may apply to the agriculture of Washington County.

This list is furnished by the North Carolina State College, Raleigh, N. C.

North Carolina Agricultural College Agronomy Information Circulars 4, Soil Acidity and Lime for North Carolina Soils; and 11, Results of Soil Building Demonstrations in North Carolina.

North Carolina Agricultural College Extension Folder 8, Tobacco Plant Beds.

North Carolina Agricultural College Extension Circulars 24, How to Use Lime on the Farm; 57, Soybeans—A Future Economic Factor in North Carolina; 123, The Farm Garden; 127, Soybean Growing in North Carolina; and 165, Crop Rotations for the Coastal Plain Section of North Carolina.

rule, the dark-colored poorly drained soils are very acid and should be limed every 3 or 4 years.

Many of the soils, especially the Ruston, Norfolk, and Craven are in need of organic matter, and this can best be supplied by growing and turning under leguminous crops, such as vetch, lespedeza, and soybeans. Soybeans are probably the most practical crop to work into the rotations. If they are cut for hay, little or nothing can be turned under for soil improvement, but if the seed is harvested and the remainder of the crop plowed into the land, considerable improvement in the supply of organic matter and nitrogen and the producing powers of the soil should result. When this is done, the quantity of nitrogen needed to be added in the fertilizer may be reduced from one-fourth to one-half for the first year, and later on if this practice is continued, the seed harvested, and the residue plowed under, within a few years it probably will be unnecessary to purchase any nitrogen from commercial sources.

Deep plowing is hardly necessary on any of the light-textured soils, as breaking to a depth of 6 or 8 inches is sufficient. The heavier soils require stronger work animals and heavier machinery. Very little terracing is necessary in this county. Some of the more level, poorly drained soils should be provided with more canals or open ditches to insure better drainage.

The following crops and varieties of each are recommended as adapted to the soils of Washington County: Peanuts—Virginia Runner, Virginia Bunch, Jumbo Runner, Spanish, and North Carolina; tobacco—Cash, Jamaica, and Whitestem Orinoco; corn—Latham Double, Cocke Prolific, Highland Horsetooth, Bigg Prolific, and Indian Chief (yellow); cotton—Mexican Big Boll, Coker-Cleveland (1 $\frac{1}{16}$ -inch staple), Coker Farm Relief, Humco-Cleveland, and Carolina Foster; soybeans for seed—Herman, Mammoth Yellow, Tokyo, and Biloxi; soybeans for soil improvement—Tokyo, Mammoth Yellow, Herman, Mammoth Brown, and Otootan; soybeans for hay—Laredo, Otootan, Tokyo, Herman, and Mammoth Yellow; oats—Norton, Coker 32-1, and Fulghum.

The following crop rotations are recommended: Three-year rotation no. 1—first year, corn (for grain) with velvetbeans (for grazing), Abruzzi rye broadcast over the land in the fall (for grazing and turning under); second year, corn (for grain) with soybeans (for seed and grazing, with vines turned under), oats and vetch in the fall; and third year, oats and vetch (for hay), soybeans (for seed or hay), peanuts (for hay or grazing) or sweet-potatoes, Abruzzi rye and vetch or crimson clover in fall (for turning under). Three-year rotation no. 2—first year, corn (for grain); second year, potatoes, corn (for grain) or soybeans (for hay); and third year, soybeans (for seed, vines turned under). Two-year rotation (to be used in connection with 3-year rotation no. 1 on the lighter land of the farm)—first year, tobacco, cowpeas (for turning under) after removal of tobacco crop; and second year, cotton or peanuts, Abruzzi rye in fall (for turning under).

Washington County offers excellent opportunities for prospective home makers. Its balmy climate, abundant rainfall, and fertile soils enable the farmer to produce such a variety of early vegetables, fruits, berries, and other farm products that living at home with a bounteous food supply is not difficult.

SOILS AND THEIR INTERPRETATION

Washington County lies immediately south of Albemarle Sound, in the low seaward section of the Atlantic Coastal Plain. It is in the region of the Red and Yellow soils. With the exception of comparatively small areas in the northwestern and northern parts of the county, the land is naturally poorly drained, and the water table is in general near the surface. In the eastern part the elevation ranges from 6 to 14 feet above sea level and in the western part from 10 to 25 feet. The elevations of the eastern and western parts of the county have direct relationships to the two geological formations or so-called "terraces"—the Chowan and Pamlico. The well-defined escarpment between them is on the State highway, about halfway between Skinnersville and Scuppernong. This boundary swings in a southwest-erly direction, in a general way following the boundary between the peat and muck areas and the mineral soils. In some places there is a drop of about 5 feet from the Chowan to the Pamlico terrace, but, in general, the line between them is not well defined.

There are two distinct divisions, or groups, of soils, the mineral soils and the cumulose, or organic, soils. The mineral soils constitute about 46 percent of the total area. These soils have been derived, through the soil-forming processes, from the unconsolidated beds of clays, very fine sands, and fine sandy clays. Drainage, aeration, and oxidation have developed soils which differ widely in textural, structural, and color characteristics. All the mineral soils have developed under forest cover, and, with the exception of Hyde loam, Portsmouth fine sandy loam, and Bladen loam, there is very little organic matter in the surface soils. In the wooded areas, the admixture of partly decomposed organic matter is sufficient to give a dark color to the first 1 to 3 inches of soil. The Hyde and Portsmouth soils have developed under swampy and semiswampy conditions which have favored the growth of a rank vegetation, and the decay of this organic matter from the leaves and plants has been expedited through saturation with water. The organic matter has been mixed with the soil in sufficiently large quantities to give the soils a black color to a depth ranging from 12 to 30 inches. All the soils range from slightly acid to strongly acid, the more poorly drained and dark-colored soils being strongly acid.

In table 5 are shown the results of pH determinations on samples of three soils. These determinations were made by E. H. Bailey, Bureau of Chemistry and Soils, by the hydrogen-electrode method.

TABLE 5.—*pH determinations on three soils from Washington County, N. C.*

Soil type and sample no.	Depth	pH	Soil type and sample no.	Depth	pH
Norfolk fine sandy loam:	<i>Inches</i>		Hyde loam:	<i>Inches</i>	
238505-----	0-3	4.3	238520-----	0-30	3.9
238506-----	3-15	5.2	238521-----	30-50	4.2
238507-----	15-28	4.5	Portsmouth very fine sandy loam:		
238508-----	28-40	4.7	238513-----	0-8	3.9
			238514-----	8-15	4.7
			238515-----	15-40	4.0

The cumulose, or organic soils occupy approximately 54 percent of the area of the county. This group includes a very large area of peat and small areas of muck and swamp. These materials have been classed as peat and muck because they are composed almost entirely of organic matter ranging from brown fibrous and only partly decomposed plant remains to black, finely divided organic matter with a very small percentage of mineral matter. All these soils, with the exception of local variations, are strongly acid.

Over the greater part of the county the soils are young and have not developed a normal soil profile. The various stages of soil development constituting an ascending series from youngest to most mature are as follows: Swamp, Bladen, Portsmouth, Lenoir, Craven, Norfolk, and Ruston. Very few of the soils have normally developed profiles. Norfolk fine sandy loam and Ruston fine sandy loam may be considered the normally developed soils, and the profile of Craven fine sandy loam has the beginning of a normally developed B horizon.

The normally developed soils, which occur only in the northern and northwestern parts of the county and lie in close proximity to the drainageways, show considerable eluviation in the surface soil. The A₁ and A₂ layers are dominantly light textured and have been leached of most of their alkaline earths and soluble plant nutrients. The B horizon in these profiles shows distinctly the effects of eluviation, or the accumulation of finer materials. This layer is heavier in texture and structure, more uniform in color, contains more plant nutrients, and is the reservoir for the greatest amount of soil moisture in the profile. In these normally developed soils the material in the C horizon is variable, but it is everywhere lighter in texture and more variable in structure than that in the B horizon. This lighter textured material in the C horizon, together with good drainage, accounts for the somewhat red colors in the B horizon of the Ruston soil. Here the iron salts have evidently oxidized, and the colorations have been distributed throughout the fine sandy clay, or the B horizon.

There are large areas, particularly in the eastern part of the county and south and east of the belt of well-drained soils, in which natural drainage has not been established and which maintain in a general way the constructional form of the land as laid down by the sea. Because of poor drainage, aeration, and oxidation, the Lenoir, Bladen, Portsmouth, and Hyde soils have not developed a normal soil profile, as the soil-forming processes have not had an opportunity to act on the original material and produce uniform color, texture, or structure. In most places, there is no line of demarcation between the horizons in the profile. The mottled or streaked coloration, particularly of the subsoil, indicates alternate wetting and drying. The substratum, or the lower part of the subsoils, of some of these soils is steel-gray clay which indicates that no aeration or oxidation has taken place in the iron salts.

The soils of Washington County can best be interpreted by individual profile descriptions at definite locations for the important

soils. Such a description of a profile of Norfolk fine sandy loam, 6½ miles southwest of Plymouth, follows:

Horizon A₁. 0 to 3 inches, gray fine sandy loam containing a slight amount of organic matter.

Horizon A₂. 3 to 15 inches, grayish-yellow loamy fine sand.

Horizon B. 15 to 28 inches, yellow friable and crumbly fine sandy clay of uniform color, which shows no definite soil structure but readily crumbles into a friable mealy mass.

Horizon C. 28 to 40 or more inches, mottled light-gray, yellow, and reddish-brown fine sandy clay material.

Although Norfolk fine sandy loam is a representative Yellow soil in this county, it has not developed such a thick B horizon as it has in the higher or better drained parts of the coastal plain.

The Craven soils have slightly paler gray surface soils than have the Norfolk soils. The main difference between the Craven and Norfolk soils is in the B horizon which, in the Craven soils, consists of heavy tough clay. This clay when wet is plastic and sticky, but on drying breaks into irregular-shaped lumps and is very hard. The B₂ horizon is yellow, mottled with steel gray and reddish brown, tough plastic clay. The C horizon consists of light-gray, mottled with yellow or reddish brown, clay material.

A description of a profile of Bladen silt loam, one-half mile west of Scuppernong, is as follows:

Horizon A₁. 0 to 7 inches, gray silt loam.

Horizon A₂. 7 to 11 inches, light-gray silty clay loam mottled with rust brown.

Horizon B. 11 to 38 inches, steel-gray, mottled or streaked with ochreous yellow, heavy clay which is so plastic and sticky that the querls can readily be pulled from the channels of the auger.

The Lenoir soils are intermediate, in position, color, and consistence, between the Craven and Bladen soils. The A₁ horizon of the Lenoir soil is gray fine sandy loam, and the subsurface layer, or A₂ horizon, is grayish-yellow heavy fine sandy loam. The B horizon consists of mottled light-gray, yellow, and a small amount of reddish-brown tough heavy clay.

The Portsmouth soils are black or dark gray in the surface layer, and they contain a large quantity of organic matter. The subsurface layer is very light gray and is a few inches thick. Below this is light-gray, mottled with yellow or rust brown, friable slightly sticky fine sandy clay.

The Hyde soils differ from the Portsmouth in that the organic matter is more finely divided, has become thoroughly mixed with the mineral material, and extends to a much greater depth. The underlying material is, in most places, drab or drabbish-brown, faintly mottled with rust brown, fine sandy clay or silty clay.

In a sample of peat, 3 miles east of Wenona, the 3-inch surface layer is black granular peat consisting of well-decomposed organic matter, together with a large quantity of small, hard, angular, burned particles. Between depths of 3 and 12 inches, the brown peat is fairly well decomposed, slick, and slightly plastic. This layer cracks on drying, and the material apparently runs together and forms a layer almost impervious to water when wet. From a depth of 12 to a depth of 48 inches, the material is brown fibrous peat containing many small roots and partly decomposed blades of vegetation. Underlying this, and continuing to a depth

of about 54 inches, is black sticky slightly plastic finely divided organic matter, with some silt and clay. At a depth of about 60 inches gray sticky white sand is reached. Near the surface and particularly at a depth ranging from about 30 to 36 inches below the surface, there are a large number of logs, some of which have decayed into brown fibrous woody peat.

Muck is dark-brown or black well-decayed vegetable matter containing considerable quantities of mineral material. Swamp represents material variable in texture, color, and structure, which is permanently wet or covered with water.

SUMMARY

Washington County is in the northeastern part of North Carolina. The surface relief ranges from level to undulating and gently rolling. Only a small proportion of the land is naturally well drained, but drainage over a large part of the more level areas has been effected by canals and open ditches.

The climate is mild, and the rainfall is abundant and well distributed throughout the growing season. The fall months are generally dry.

The present-day agriculture consists of the production of peanuts, tobacco, and cotton, together with a small quantity of potatoes, green peas, and tomatoes as cash crops, and corn, soybeans, sweetpotatoes, and hay as subsistence crops.

The soils of this county are divided into three main groups. The first comprises the light-colored well-drained soils and includes all the soils of the Norfolk, Ruston, and Craven series. These soils produce all the tobacco, most of the truck crops, and a large percentage of the peanuts and cotton grown. The second group, or light-colored poorly drained soils, includes all the Bladen (except Bladen loam) and Lenoir soils. The principal crops on these soils are corn, soybeans, cotton, peanuts, and potatoes. The third group, or the black poorly drained soils, includes all the soils of the Hyde and Portsmouth series, in addition to Bladen loam, muck, peat, and swamp. The Hyde and Portsmouth soils are considered excellent for corn, soybeans, and potatoes. A large proportion of the Hyde soil is under cultivation but practically none of the Portsmouth. Only a small percentage of Bladen loam, muck, and peat is cultivated.



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